



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/555,144	10/31/2005	Cheng C. Ko	10555-112	3937
7590	09/18/2007		EXAMINER	
Brinks Hofer Gilson & Lione PO Box 10395 Chicago, IL 60610			YEALY, CHRISTOPHER M	
			ART UNIT	PAPER NUMBER
			2878	
			MAIL DATE	DELIVERY MODE
			09/18/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/555,144

Applicant(s)

KO ET AL.

Examiner

Christopher M. Yealy

Art Unit

2878

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-26 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-26 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 31 October 2005 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. ____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- ☒ Notice of References Cited (PTO-892)
- ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- ☒ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date 7/23/2007.
- ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. ____.
- ☐ Notice of Informal Patent Application
- ☐ Other: ____.

DETAILED ACTION

Specification

The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.

The following title is suggested: PIN Photodetector with Mini-Mesa Contact Layer.

Claim Objections

Claim 1 is objected to because of the following informalities:

Claim 1, line 11: "passivation layers" should read "passivation layer"

Appropriate correction is required.

Double Patenting

1. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to

be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

2. **Claim 1** is provisionally rejected on the ground of nonstatutory obviousness-type

double patenting as being unpatentable over claim 46 of copending Application No.

10/836878. Although the conflicting claims are not identical, they are not patentably

distinct from each other because claim 46 comprises a first mini-mesa semiconductor

contact layer, a semiconductor absorption layer, a semiconductor passivation layer

between the mini-mesa and the absorption layer, and a second semiconductor contact

layer, wherein the absorption layer and the passivation layer are positioned between the

mini-mesa layer and the second semiconductor contact layer.

This is a provisional obviousness-type double patenting rejection because the conflicting claims have not in fact been patented.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

4. **Claims 1, 2, 4, 8, 9, 11, 14-19, 21, 25, and 26** are rejected under 35

U.S.C. 102(e) as being anticipated by **Clark (U.S. Patent # 6,794,631 B2)**.

Regarding **claim 1**, Clark discloses (see Figure 2) a PIN photodetector comprising:

- a first semiconductor contact layer (112a) configured as a mini-mesa structure;

- a semiconductor absorption layer (107), the mini-mesa structure (112a) having a smaller area than the semiconductor absorption layer;

- a semiconductor passivation layer (109) positioned between the mini-mesa structure (112a) and the semiconductor absorption layer (107), relative to the passivation layer and the absorption layer, the mini-mesa structure being in direct physical contact with only the passivation layer; and

- a second semiconductor contact layer (101), the semiconductor absorption layer (107) and passivation layer (109) being positioned between the mini-mesa structure (112a) and the second semiconductor contact layer (column 4, lines 10-20; column 5, lines 16-40).

Regarding **claim 18**, Clark discloses (see Figure 2) a method of fabricating a PIN photodetector comprising:

- providing a lower semiconductor contact layer (101);

- depositing a semiconductor absorption layer (107);

- depositing a semiconductor passivation layer (109); and

- depositing or fabricating an upper semiconductor contact layer (112a) configured as a mini-mesa structure having a smaller area than the semiconductor absorption layer, relative to the passivation layer and the

absorption layer, the mini-mesa structure being in direct physical contact with only the passivation layer (109) (column 4, lines 10-20; column 5, lines 16-40).

Regarding **claims 2 and 19**, Clark discloses that the semiconductor absorption layer is InGaAs (column 5, lines 19-25).

Regarding **claims 4 and 21**, Clark discloses (see Figure 2) that the mini-mesa structure (112a) is a p-type and the second, lower semiconductor contact layer (101) is an n-type (column 4, lines 15-20; column 5, lines 34-40).

Regarding **claims 8 and 9**, Clark discloses (see Figure 2) that the photodetector further comprises a p-type first metal contact (111) positioned adjacent to the mini-mesa structure (112a) and at least one n-type second metal contact (110) positioned adjacent to the second semiconductor contact layer (101) (column 4, lines 15-20; column 5; lines 34-40).

Regarding **claim 11 and 25**, Clark discloses (see Figure 2) that the photodetector further comprises a first bandgap grading layer (108) positioned between the semiconductor passivation layer (109) and the semiconductor absorption layer (107) and a second bandgap grading layer (106) positioned between the semiconductor absorption layer (107) and the second semiconductor contact layer (101) (column 4, lines 54-65; column 5, lines 16-25).

Regarding **claims 14-16**, Clark discloses that the photodiode has a dark current behavior that is substantially constant relative to an initial value, the photodiode has a dark current behavior that is substantially constant relative to an initial value over a time

period greater than 2000 hours, and the photodiode has a lifetime that exceeds twenty years (column 8, lines 3-18).

Regarding **claims 17 and 26**, Clark discloses that the semiconductors include InP (column 4, lines 10-20; column 5, lines 16-25).

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. **Claims 3, 7, 12, 20, and 24** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Clark (U.S. Patent # 6,794,631 B2)** in view of **Tanaka et al. (U.S. Patent # 6,635,908 B2)**.

Regarding **claims 3 and 20**, Clark discloses the device of claim 1 and the method of claim 18, but does not disclose that the passivation layer is InAlAs.

Tanaka et al. teaches (see Figure 1) a photodetector wherein a passivation layer (4) is InAlAs (column 3, lines 25-33).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to modify the invention of Clark with a passivation layer of InAlAs, as taught by Tanaka et al., in order to control electric field intensity in the photodetector.

Regarding **claims 7 and 24**, Clark discloses the device of claim 1 and the method of claim 18, but does not disclose a second semiconductor passivation layer about the first passivation layer and the absorption layer.

Tanaka et al. teaches (see Figure 1) a photodetector comprising a second semiconductor passivation layer (8) positioned about the first semiconductor passivation layer (4) and the semiconductor absorption layer (5) (column 2, line 63 – column 3, line 17).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to modify the invention of Clark with a second passivation layer about the first passivation layer and the absorption layer, as taught by Tanaka et al., in order to control electric field intensity in the photodetector.

Regarding **claim 12**, Clark discloses the device of claim 1, but does not disclose that the electric field near the center of the absorption layer is greater than the electric field near the edges.

Tanaka et al. teaches (see Figure 2) a photodetector wherein the electric field near the center (one-dot chain line) of the semiconductor absorption layer is greater than the electric field near the edges (solid line) of the semiconductor absorption layer (column 3, lines 1-17).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to modify the invention of Clark with a electric field near the center that is greater than the electric field near the edges, as taught by Tanaka et al., in order to reduce dark current and improve reliability.

7. **Claims 5, 10, and 22** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Clark (U.S. Patent # 6,794,631 B2)** in view of **Uchiyama et al. (U.S. Patent # 4,885,622)**.

Regarding **claims 5 and 22**, Clark discloses the device of claim 1 and the method of claim 18, but does not disclose that the mini-mesa structure is an n-type and the second semiconductor contact layer is a p-type.

Uchiyama et al. teaches (see Figure 2) a photodetector wherein the mini-mesa structure (25) is an n-type and the second semiconductor contact layer (23) is a p-type (column 3, lines 8-23).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to modify the invention of Clark with an n-type mini-mesa structure and a p-type second semiconductor contact layer, as taught by Uchiyama et al., in order to increase the response rate of the photodetector.

Regarding **claim 10**, Clark discloses the device of claim 8, including an n-type metal contact adjacent an n-type semiconductor contact layer and a p-type metal contact adjacent a p-type semiconductor contact layer, but does not disclose that the first metal contact is an n-type and the second metal contact is a p-type.

Uchiyama et al. teaches (see Figure 2) a photodetector wherein the mini-mesa structure (25) is an n-type and the second semiconductor contact layer (23) is a p-type (column 3, lines 8-23).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to modify the invention of Clark with an n-type first metal contact and a p-type second metal contact, as taught by Uchiyama et al., in order to form ohmic contacts to the NIP photodetector.

8. **Claims 6 and 23** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Clark (U.S. Patent # 6,794,631 B2)** in view of **Uchiyama et al. (U.S. Patent # 4,885,622)**, and further in view of **Ko (Pub # US 2005/0029541 A1)**.

The applied reference has a common inventor with the instant application. Based upon the earlier effective U.S. filing date of the reference, it constitutes prior art only under 35 U.S.C. 102(e). This rejection under 35 U.S.C. 103(a) might be overcome by: (1) a showing under 37 CFR 1.132 that any invention disclosed but not claimed in the reference was derived from the inventor of this application and is thus not an invention "by another"; (2) a showing of a date of invention for the claimed subject matter of the application which corresponds to subject matter disclosed but not claimed in the reference, prior to the effective U.S. filing date of the reference under 37 CFR 1.131; or (3) an oath or declaration under 37 CFR 1.130 stating that the application and reference are currently owned by the same party and that the inventor named in the application is the prior inventor under 35 U.S.C. 104, together with a terminal disclaimer in accordance with 37 CFR 1.321(c). This rejection might also be overcome by showing that the reference is disqualified under 35 U.S.C. 103(c) as prior art in a rejection under 35 U.S.C. 103(a). See MPEP § 706.02(l)(1) and § 706.02(l)(2).

Regarding **claims 6 and 23**, Clark, as modified by Uchiyama et al., teaches the device of claim 5 and the method of claim 22, but they do not teach that the first semiconductor contact layer and the second semiconductor contact layer are InAlAs.

Ko teaches (see Figure 1) a photodetector wherein the first semiconductor contact layer (28) and the second semiconductor contact layer (16) are InAlAs (paragraph 17).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to modify the invention of Clark, in view of Uchiyama et al., with first and second semiconductor contact layers of InAlAs, as taught by Ko, in order to reduce the number of materials needed to fabricate the photodetector.

9. **Claim 13** is rejected under 35 U.S.C. 103(a) as being unpatentable over **Clark (U.S. Patent # 6,794,631 B2)** in view of **Funaba et al. (U.S. Patent # 5,880,489)**.

Regarding **claim 13**, Clark discloses the device of claim 1, but does not disclose that the capacitance of the photodiode is determined by the area of the mini-mesa structure.

Funaba et al. teaches (see Figure 5) a photodetector wherein the capacitance of the photodiode is determined by the area of the first semiconductor contact layer (6) (column 17, lines 32-41).

It would have been obvious to a person of ordinary skill in the art at the time the invention was made to modify the invention of Clark, with a capacitance determined by

the area of the mini-mesa structure, as taught by Funaba et al., in order to increase high-speed operation of the photodetector.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Dawe (Pub # GB 2240874 A), Yano (U.S. Patent # 5,448,099), and Yuan (U.S. Patent # 6,756,613 B2) disclose a photodetector comprising a first mini-mesa semiconductor contact layer, an absorption layer, a passivation layer, and a second semiconductor contact layer of InP.

Lindemann et al. (U.S. Patent # 6,774,448 B1) discloses a photodetector comprising a first mini-mesa semiconductor contact layer, an absorption layer, and a second semiconductor contact layer.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Christopher M. Yealy whose telephone number is (571) 270-1324. The examiner can normally be reached on Monday - Thursday, 7:00am - 5:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Georgia Y. Epps can be reached on (571) 272-2328. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Art Unit: 2878

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

CMY

Christopher M. Yealy
Art Unit 2878
September 4, 2007

Georgia Epps
Georgia Epps
Supervisory Patent Examiner
Technology Center 2800